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WHITE PAPER

Why Regulatory & Environmental Compliance is Driving Demand for Natural Gas-powered Generators

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INTRODUCTION

In the last 10 years, the standby generator market has seen a dramatic increase in the demand for natural gas generators. While various factors, including a rise in natural gas availability and reliability, are partially responsible for this recent rise, this white paper will analyze regulatory and environmental components that have also affected the demand for natural gas-powered applications.

"Where acceptable to the authority having jurisdiction, the use of other than on-site fuels shall be permitted where there is a low probability of simultaneous failure of both the off-site fuel delivery system and power from the outside electrical utility company."

EPA

In 1998, the Environmental Protection Agency (EPA) increased their scope of regulations for the use of diesel (compression-ignition) engines in nonroad applications. These include construction equipment, heavy-haul trucks and mobile drilling rigs. The standards were implemented over time in a tiered structure and intended to cut down on pollutants attributed to compression-ignition engines: oxides of nitrogen (NOx), carbon monoxide (CO) and particulate matter (PM) with a primary focus on NOx. The tier level that applied to specific products depended upon the engine's horsepower and date of manufacture. As regulations eventually tightened from Tier 1 to Tier 4, the cost of diesel engines — and in some cases the required after treatment — doubled.

Initially exempt from these regulations were stationary engines used in applications such as generators and air compressors. However, in 2006, these units were added to the regulatory list, as well. With the EPA's release of their New Source Performance Standards (NSPS) in 2011, stationary generators were required to meet the same standards as mobile equipment unless they were strictly being used as an emergency source.

While stationary diesel generators that are used as emergency sources are relieved of NSPS standards, they are limited to 100 hours of operation annually for storm avoidance and emergency demand response. Per the EPA, these generators cannot be used for peak shaving, nonemergency demand response, to generate income or otherwise supply power as part of a financial arrangement with another entity.

To this day, stationary spark-ignited generator sets have not been affected, but in 2013, the EPA released the Reciprocating Internal Combustion Engine National Emissions Standard for Hazardous Air Pollutants (RICE NESHAP). By setting this standard, the EPA was again looking to reduce the effluence of internal combustion engines. But this time, the primary focus was on CO. This standard for spark-ignited engines did not use a tiered structure but set standards for generators used in either emergency or nonemergency applications. This put spark-ignited products in the same category as diesel-powered products, aligning them with the same runtime restrictions in addition to financial arrangement limitations. However, natural gas generators are able to reach the nonemergency certifications with much less additional effort than diesel-powered products. This makes natural gas a more attractive choice when considering peak shaving and demand response applications.

EFFECTS OF EMISSIONS REGULATIONS

In addition to the regulations on engine output, in 2006, the EPA began to phase in more stringent regulations on what went into the engines. In this case, the focus was on sulfur. Prior to 2006, generally available diesel fuel had a sulfur content of nearly 5000 parts per million (ppm). The byproducts of burning high-sulfur fuel were oxides of sulfur — SO2 and SO3 — which could form sulfuric acid in the atmosphere and create acid rain. The regulations first reduced the sulfur content to 500 ppm, creating low sulfur diesel (LSD). Sulfur was then reduced even further to 15 ppm, creating ultra-low sulfur diesel (ULSD). Stationary products like generators started using LSD in 2007, with ULSD being the norm after 2014. To date, there are no EPA regulations regarding the chemical composition of natural gas, and NFPA 110-5.1.1 leaves any natural gas fuel quality issues to be addressed by the pipeline gas provider.

One item that may have been overlooked during the sulfur regulations is the role that sulfur plays in the storage of diesel fuel. As a natural biocide, sulfur previously eliminated much of the bacteria that can be found in stored diesel fuel. However, after being reduced from 5000 to 500 ppm — and ultimately to 15 ppm — bacteria is now able to grow unfettered within fuel tanks. This has given rise to an entire industry of fuel polishing cleaning systems and services, as owners of critical and emergency systems look for solutions to keep their fuel systems reliable. This is supported by NFPA 110-8.3.7, which calls for fuel quality tests for diesel tanks. This added operating and maintenance expense has pushed many owners and designers to consider natural gas as a fuel source that eliminates the need for this additional work.

NEC AND NFPA

At the same time that the EPA was looking at providing regulations for use of reciprocating engines, the safety standards that applied to the use of generator sets also considered generator applications and the acceptance of different fuels. The National Electric Code (NEC), the National Fire Prevention Association (NFPA) and the standard for stationary generators (NFPA 110) were making changes.

Up until the early 2000s, it was generally accepted that generators used for emergency standby power had to be powered by diesel fuel. The availability of diesel engines, a 10-second power restoration requirement (NFPA 99 7.9.2.2, NFPA 110 table 4.1) and the reliability of on-site fuel storage made this an easy decision. However, dating as far back as the 1990s, the NEC placed a note in section 700.12 for Emergency Systems, recognizing that natural gas can be a reasonable alternative for life safety loads:

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While this puts the burden of acceptability on the Authority Having Jurisdiction (AHJ), the NEC has clearly stated that they have no issue with natural gas as a fuel source for emergency standby systems.

In conjunction with the consequences of EPA regulations related to diesel fuel, NFPA 110 has recognized the growth and practicality of natural gas generators used in emergency standby applications. NFPA 110-8.4.2 spells out the monthly testing requirements for diesel generator sets, mandating a 30-minute load test with no less than 30 percent of the standby nameplate kW rating. Many generator exercise tests are scheduled for early in the morning when building load is at its minimum and the 30 percent threshold is hard to reach. If this is the case, the standard requires an annual 90-minute load bank test to be performed with supplemental load banks at least 75 percent of the standby nameplate rating of the generator. All this comes at an additional operating cost to the owner.

In 2005, the NFPA changed testing procedures for spark-ignited generator sets by only requiring a 30-minute test monthly with whatever load is available. With this change, no minimum load threshold or annual load test is required (NFPA 110-8.4.2.4).

Fuel storage regulation is another area in which the NFPA standards demonstrate limitations to diesel-fueled generators that do not apply to natural gas engines. NFPA 37, the Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines, regulates fuel storage capacities for indoor installations. For indoor applications, NFPA 37-6.3.2.2 limits the size of the generator fuel tank to 660 gal. For a 500 kW diesel generator, this limits the generator to 21 hours of runtime on a single tank. Many diesel generator installations today call for 24 to 48 hours of fuel storage. In these cases, an indoor diesel generator will require a fuel transfer system that includes pumps, floats, controls, valves, etc. This requires the placement of an additional storage tank outside the building.

Having accounted for nearly 34 percent of the United States' electric output in 2016, the market for clean, reliable natural gas continues to grow, and the codes and standards that regulate standby generators have taken notice. Changes in the EPA, NEC and NFPA standards have recognized that natural gas is a viable fuel source for life safety applications as well as a natural complement to utility peak shave and demand response programs. Consult your local Generac distributor to learn more about the flexibility of natural gas generators.